Title: SLIDING WALL

Description

The invention is directed to a sliding wall with a plurality of laterally displaceable wall elements which are guided by means of running rollers at a carrying profile arranged above the wall elements. At least one of these wall elements is constructed with a drive unit for actuating the wall element as a rotating leaf, the drive unit being arranged so as to be stationary with respect to the displaceable wall element. Actuating means which can automatically operate or be inactive by means of a rod linkage when the wall element is displaced are provided between the drive unit and the rotating leaf.

A sliding wall with a plurality of laterally displaceable wall elements that are displaceable by means of running rollers along a sliding rail is described in DE 199 59 825 C1. At least one wall element is constructed as a rotating leaf that can be actuated by a door closer. A sliding rail rod linkage which automatically couples or uncouples is arranged between the door closer and the wall element that serves as a rotating leaf. The arrangement of the individual wall elements with respect to one another is realized by means of fittings. This means that when moving the sliding wall with all of its elements, these elements must always be moved in their entirety. This imparts a correspondingly high stability to the elements of the sliding wall with respect to one another. Further, there is a locking member by means of which the rotating leaf can only be actuated when the entire sliding installation is in the closed position. The rotating door drive unit which is mounted in a stationary manner is released in this position. Due to the design of the suspension of the rotating leaf, that is, due to the fact that the suspension is not arranged at the displaceable and rotatable wall element, the suspension is relieved because the weight of the drive device is structurally absorbed.

It is the object of the invention to further develop the prior art in such a way that a drive unit according to DE 199 59 825 C1 can be used in any type of sliding wall.

This object is met in that a sliding wall comprising individual wall elements which are movable manually or by motor has a bottom guide which is guided, particularly in a wall element formed as a rotating leaf, at the upper end and lower end of the leaf. Further, the rotating leaf has a first swivel pin and a second swivel pin in order to impart corresponding

stability to the rotating leaf during a rotating movement. Further, the individual wall elements are automatically coupled with one another at the moment that they form a closed front, so that the rotating leaf can swivel without risk.

The above-stated object is met according to patent claim 1 through the characteristic features indicated therein. The subclaims show advantageous further developments of the invention.

In order to form a first and second swivel pin, the rotating leaf is outfitted with at least one lever arm. Further, the rotating leaf is guided in an upper and a lower end area by means of the above-mentioned guide elements in a bottom rail and a top carrying rail. Due to this arrangement according to the invention, the rotating leaf swivels around the lever arm as well as around the guide elements which are moved in an upper, additional guide rail as the swiveling of the door leaf element progresses. In so doing, the main closing edge of the rotating leaf travels an elliptic path. Sufficient stability is imparted to the swiveling movement by means of a three-point bearing support, namely, in that it is guided in the upper area and the lower area of the wall element.

The lever arm can be articulated at an upper and a lower door leaf end. However, it is also possible that the rotating element has only an upper lever arm or only a lower lever arm.

In order to provide a particularly compact construction, the lever arm or lever arms of the wall element (rotating leaf) is or are preferably arranged in a cutout provided in a leaf profile.

A running rail is particularly preferably arranged in a suspension profile. A running carriage is preferably introduced into this running rail so as to be movable. The running carriage is preferably connected to the rotating leaf of the wall element by means of a pendulum mounting. It is noted that this construction of the wall element according to the invention comprises the door leaf as well as the suspension profile and the leaf profile which is connected directly to the leaf.

A locking device which is constructed as a coupling member and locking member simultaneously is provided in order to achieve a secure rotating leaf element. In this way, the wall element according to the invention can be locked with an adjoining wall element without the conventional locking arrangement in the base. This ensures a reliable actuation of the door.

In order to generate as little additional loading as possible during the swiveling of the rotating leaf, the guide elements of the rotating leaf are arranged in the rails approximately

midway along the width of the door leaf. Accordingly, there is also a center of gravity in the center of the door leaf when the door leaf is swiveled.

The connection device mentioned above can comprise two partial elements corresponding to one another, each partial element being integrated at or in two abutting wall elements.

For this purpose, for example, a first partial element comprising a flat arm in the form of a coupling element can be integrated in a wall element that can not swivel. The coupling element has, at its end, a coupling pin which cooperates with the second partial element that is contained in the wall element to be swiveled. A second partial element of this type can be a fixing element and a locking element at the same time.

When there are two wall elements which move toward one another, one of them being arranged in such a way that it contains a rotating leaf while the other is constructed exclusively as a wall element, locking is carried out only when a movement of the rotating leaf is initiated after the two wall elements have been moved together by pressing on the rotating leaf or by means of the drive unit described above. Locking of the rotating leaf is carried out by means of a lever arm with the adjacent wall element. A locking element of this kind can substantially comprise a connection element which is provided with a bore hole in which the coupling pin of the adjacent wall element catches when actuation (rotation of the rotating leaf) is carried out. In order to achieve an exact alignment, there is an adjusting screw which makes it possible to adjust the connection element.

In order to lock the two leaves together, a coordinating element is provided which has one or two locking bevels in an end area. These locking bevels are so designed that the bevels slope toward the outer edges and there is a plane unlocking surface in their center area. The adjusting screw also functions simultaneously as a releasing element for the locking element because the end of the adjusting screw rests on the unlocking surface. When the rotating leaf is caused to swivel, the adjusting screw slides down at one of the locking bevels which simultaneously lowers the connection element. Therefore, in the correct position, the coupling pin can penetrate into a bore hole inside the connection element; this means that the two adjacent wall elements are connected to one another immediately when the rotating leaf is swiveled even slightly. In order to facilitate interlocking with the lever arm, this lever arm is provided with a conically tapering opening at its end so that the coupling pin is automatically moved into the correct position.

Further, the coupling pin also performs the function of fixing the wall elements to one another, specifically in such a way that an oppositely located end of the coupling pin can be inserted into a coupling opening of the coordinating element. This coupling opening has a conical shape which tapers toward the back. After a certain depth, however, the coupling opening widens, namely so as to provide an adequate possibility for the coupling pin to exit from the coordinating element again when the pin is swiveled as described above.

In another construction of the invention, the lever arm has a second locking possibility at its opposite end at which the locking element is located. This comprises a half-circular element having in its central area a notch that cooperates with an element that is connected to the lower profile of the rotating leaf so as to be stationary. The purpose of this locking arrangement is to hold the lever in its rest position when not coupling with an adjacent wall element.

A sliding wall of the type described above, as a wall system, can be moved out of a parked position into the use position automatically without additional manipulation. At the same time, actuation of a rotating leaf can be carried out in the use position without manual force. The position of a rotating leaf of this kind depends on whether or not a corresponding automatic drive unit is installed in the top area. An automatic drive unit of this kind can be installed at practically any location of the installation. This increases the flexibility of such sliding walls enormously.

The construction of the wall elements according to the invention is used particularly in wall elements made of glass. However, such designs are, of course, also possible with wall elements made of wood, metal, plastic or the like. Because of the integral construction within a sliding wall through rotatable wall elements, a wall element of this kind can already be completely preassembled in the factory, so that only a little assembly work is necessary on the installation site. Accordingly, it is only necessary to insert the door element into the upper guide rail and lower guide rail on site.

The invention will be described in the following through an embodiment example with reference to the drawings. The drawings show an embodiment example schematically. Details not relevant to the invention and not contributing to an understanding thereof are omitted.

Figure 1 shows a schematic side view of a sliding wall system with a rotating leaf according to the present invention;

Figure 2 shows a top view of a possible construction of a sliding wall with two automatic rotating leafs;

Figure 3 shows a partial section through an upper carrying profile and a lower guide rail and a side view of a drive unit with a rotating leaf;

Figure 4 shows a partial section of two adjacent wall elements prior to coupling;

Figure 5 shows a view similar to Figure 4, but in the coupled state;

Figure 6 shows a view similar to Figure 5, but with a swiveled rotating leaf with locking of the two adjacent leaves;

Figure 7 is a top view showing a partial section in a partly swiveled rotating leaf;

Figure 8 is a side view showing a coupling pin in connection with a lever arm;

Figure 9 is a perspective view of a coordinating element;

Figure 10 is a perspective view of a lever.

A sliding wall shown in Figure 1 comprises a plurality of wall elements. In the embodiment example, the plurality of wall elements comprises two displaceable wall elements 1 and a displaceable and swivelable wall element 2. The wall elements 1 are arranged adjacent to wall element 2. The wall elements 1 are arranged so as to be displaceable inside a carrying profile 8 by means of connections 4 by a fastening element 3 and a running carriage 18. The wall element 2 is similarly connected, but a suspension profile 44 is used in the upper area instead of the fastening profile 3. The connection to the carrying profile 8 is realized in the same manner as that of the displaceable wall elements 1.

In the lower area of the wall elements 1, 2, there are lower closing profiles 5 in which there are bottom guides 9 and 57 directed toward the floor or ground. The bottom guides 9, 57 engage in a guide rail 7 which is recessed into the ground, not shown more fully. It is guaranteed in this way that the wall elements 1 and 2 are able to move reliably.

A lever arm 13 which has a pivot bearing 10 at one of its ends and contains a swivel pin 15 at another end is located inside the lower closing profile 5 of the wall element 2.

A leaf profile 11 is located at the wall element 2 below the suspension profile 44. At the suspension profile 44 located above it, a lever arm 12 is supported at one end at the leaf profile 11 by a swivel pin 14 at the other end by another pivot bearing 10.

The bottom guide 57 functions at the same time as a first swivel pin which is arranged approximately in the center of the wall element 2. A swivel pin 19 that is axially aligned with the first swivel pin is located at the upper end of the leaf profile 11.

In a development of the invention, a second swiveling pin is provided for the lever arms 12, 13 with their swivel pins 14, 15, in addition to the first swivel pin 19, 57. The swivel pins 14, 15 are likewise aligned one above the other.

The embodiment example of a sliding wall in Figure 2 shows, in the left-hand area, a wall 16 from which a carrying profile 8 extends in any shape. The carrying profile 8 terminates opposite from the wall in a station in which the individual wall elements 1, 2 can be parked, that is, when the sliding wall is opened. The sliding wall is closed in the drawing, so the individual wall elements 1 and 2 remain in their use position. In the area where the wall elements 2 are arranged, there is a drive unit 55 at the top, namely, in the area of the carrying profile 8. The drive units 55 are stationary and are not moved with the sliding wall. The schematic views in Figure 2 show the opening process of the wall elements 2.

It can be seen from Figure 3 how a drive unit 55 such as that mentioned above cooperates with the wall element 2 serving as rotating leaf. The drive unit 55 which is shown in this side view in partial section is connected in a stationary manner with the carrying profile 8 and the running carriage 18 contained therein by mean of the connection 4 to the suspension profile 44. The leaf profile 11 to which the glass element of the wall element 2 is fastened is located below the suspension profile 44. To enable rotation of the wall element 2, the swivel pin 19 is connected to a running carriage, not shown, by a pendulum suspension within a sliding rail which is located in the suspension profile 44.

A sliding rail 60 having a groove 61 is located at the side of the leaf profile 11. A pin 59, which can also be provided with a roller, engages in the groove 61. The pin 59 is arranged at one end of a flat arm 56 of a rod linkage, the other end of the flat arm 56 being connected to a driven shaft of the drive unit 55 in a frictional and positive engagement.

If the drive unit 55 were actuated in the position shown in Figure 3, the driven shaft 58 would execute a rotational movement which means, at the same time, that the flat arm 56 would swivel the rotating leaf 2 due to its coupling with the sliding rail 60. The control of the drive unit 55 can be realized by a manual signal or a sensor signal.

It can also be seen from Figure 3 that during a movement of the wall element 2 in connection with the pin 59 the flat arm 56 is automatically coupled with or uncoupled from the sliding rail 60. Accordingly, the drive unit 55 can be connected to the wall element 2 so as to be ready for use without manual actuation.

As can be seen from Figure 1, the displaceable and swivelable wall element 2 comprises an upper actuation arm 12 and a lower actuation arm 13 which are constructed as levers. The upper lever arm 12 is rotatably mounted by means of the swivel pin 14 which is articulated at the leaf profile 11. Further, the upper lever arm 12 is mounted at the pivot bearing 10 at its other end. This forms an axis of rotation in the suspension profile around which the lever arm can rotate. For the most compact possible construction, the upper lever arm 12 is arranged inside a free cut, not shown in more detail, in the suspension profile 44.

The wall element 2 accordingly comprises three swivel pins, namely, the swivel pin in the area of the pivot bearing 10 at the side of the suspension profile 44 around which the actuation arm 12 swivels, and the actual swivel pins of the wall element 2, namely, the first swivel pin 19, 57 and the second swivel pin 14, 15.

The lower lever arm 13 is likewise mounted at a free end so as to be aligned with the pivot bearing 10 due to a coupling pin 26, described in the following, which is located in a coupling element 20. The lever arm 13 is connected at its opposite end to the wall element 2 by means of the second swivel pin 15 which was already mentioned. The lower lever am 13 is likewise arranged in a free cut, not shown in more detail, in the bottom closing profile 5.

Figures 4 to 7 show how the adjacent wall elements 1and 2 are connected to one another. The displaceable wall element 1 with the coupling element 20 is shown on the right-hand side of Figure 4. The coupling element 20 projects out of the displaceable wall element 1. The coupling element 20 is constructed as a flat structural component part. Inside the wall element 1, the coupling element 20 is fastened in a frictional and positive engagement in a recess 21. In the area of the free end of the coupling element 20, the coupling pin 26 is connected in a frictional and positive engagement with the coupling element 20 by means of a weld 39. The coupling pin 26 projects out of the coupling element 20 by its coupling projection 42 on one side and by its locking end 37 on the other side.

The swivelable wall element 2 is shown on the left-hand side of Figure 4. The lever arm 13 is arranged so as to be swivelable inside a cutout, not shown in more detail. A connection

element 25 which is supported on one side is located inside the lever arm 13. The connection element 25 can preferably be produced from a spring steel. The coupling element 20 penetrates into the lever arm 13 as it approaches the swivelable rotating leaf 2 and, therefore, the lever arm 13, as is shown in Figure 5. When the coupling pin 26 fits correctly inside a coordinating element 28 arranged above the lever arm 13 in the end area of the wall element 2 at the underside, an uncoupling cutout 32 results. Figure 5 shows that the coupling projection 42 cooperates with a bore hole 27 inside the connection element 25. Accordingly, the coupling projection 42 would penetrate into the bore hole 27 if the connection element 25 were lowered. This would mean that the adjacent wall elements 1 and 2 would be connected to one another and, at the same time, a swivel pin would be formed in alignment with the pivot bearing 10 in the upper area of the wall element 2.

The coordinating element 28 is shown in a perspective view in Figure 9. In the embodiment example, the coordinating element 28 has locking bevels 29 at one end which are directed away from one another and slope down toward the edge of the coordinating element 28. An unlocking surface 30 is located in the area where the locking bevels 29 would meet. The unlocking surface 30 cooperates with an adjusting screw 24 which is screwed into the connection element 25. The free end of the adjusting screw 24 projects beyond the lever arm 13 and contacts the unlocking surface 30 when the wall elements 1, 2 are aligned. This position is also shown in Figures 4 and 5. If the wall element 2 were swiveled slightly, the end of the adjusting screw 24 would slide down one of the two locking bevels 29, depending on the swiveling direction of the wall element 2, which would cause a swiveling of the connection element 25 at the same time. The swiveling is introduced as soon as the drive unit 55 causes the opening process of the wall element 2 after a corresponding coupling of wall element 1 to wall element 2. The coordinating element 28 is fastened by screws 33 through bore holes 34 which ensure a proper fit of the coordinating element 28 with the lower closing profile 5.

At its other end, the coordinating element 28 has a coupling opening 31 through which the locking end 37 of the coupling pin 26 passes. In order to facilitate insertion, the coupling opening 31 has run-in bevels 35 which narrow conically, i.e., taper, toward the center of the coordinating element 28. At a certain point, the run-in bevels 35 continue into run-out bevels 36 which extend conically away from one another. The run-out bevels 36 end in the uncoupling cutout 32.

The cooperation of the coordinating element 28 and the connection element 25 with the coupling element 20 and the coupling pin 26 results in a device for coupling while simultaneously forming a locking member which secures the wall element 2 in the occupied position after swiveling the wall element 2 only slightly.

Figure 7 shows a rotation and simultaneous swiveling by means of the swiveling devices 46, 47 of the wall element 2 relative to the wall element 1. It can be seen that a tip, not shown in more detail, of the adjusting screw 14 projects out of the lever arm 13 through an elongated hole in the form of an opening 45. Further, the lever arm 13 has a conical inlet 48 at its free end in the area of the connection element 25 in order to facilitate entry of the coupling pin 26.

Figure 8 shows the arrangement and construction of the coupling pin 26. The locking end 37 is inserted into the coupling element 20 and is connected to it in a frictional and positive engagement by means of a weld 39. There is a projection 38 above the coupling element 20. Connected to the projection 38 is a frustum 40 with adjoining surface 41 and another frustum 40. The latter passes into the coupling projection 42. The frustums serve to facilitate entry into the lever arm 13 and also into the coordinating element 28.

The lever arm is shown separately in a perspective view in Figure 10. The lever arm has the connection element 25 in its left-hand end area and an additional possibility for locking the lever 13 in its right-hand end area, so that this lever 13 does not exit its use position when the wall element 2 is displaced. The locking device comprises an end piece 50 having in its outer area a half-circular shape 50 which contains a notch 52 in its central area. A locking pin 54 (Figure 7) cooperates with the notch 52 and is contained in a threaded bore hole 53 of an angle 49. The angle 49 is fastened to the lower closing profile 5 in a frictional and positive engagement.

Reference Numbers

1 displaceable wall element
2 displaceable and swivelable wall element
3 fastening profile
4 connection
5 lower closing profile
7 guide rail
8 carrying profile
9 bottom guide (swivel pin)
10 pivot bearing
11 leaf profile
12 lever arm
13 lever arm
14 swivel pin
15 swivel pin
16 wall
17 station
18 running carriage
19 pin (swivel pin)
20 coupling element
21 recess
24 adjusting screw
25 connection element
26 coupling pin
27 bore hole
28 coordinating element
29 locking bevel
30 unlocking surface
31 coupling opening
32 uncoupling cutout

33 screw
34 bore hole
35 run-in bevel
36 run-out bevel
37 locking end
38 projection
39 weld
40 frustum
41 surface
42 coupling projection
44 suspension profile
45 opening
46 swiveling direction
47 swiveling direction
48 conical run-in
49 angle
50 end piece
51 half-circular shape
52 notch
53 threaded bore hole
54 locking pin
55 drive unit
56 flat arm
57 bottom guide (swivel pin)
58 driven shaft
59 pin (roller)
60 sliding rail
61 groove